

## Assessment of Factors Influencing the Abbreviated Surgical Health Care Experience

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### ABSTRACT

**Objectives:** Clear benefits of minimally invasive surgery to patients are shorter hospitalization, less preoperative evaluation and diagnostic studies, less intense postoperative care, earlier return to family, strenuous activities and work, and less interaction with the physician, surgeon, nurse, and other healthcare team personnel. These positive effects of modern surgical healthcare are countered by an associated decrease in physician-patient contact, decrease in development of trusting relationships with the surgical healthcare team, markedly increased anxiety on the part of the patients, fragmented relationships with the healthcare team, misunderstanding of medical recommendations, treatment options, and associated expectations. This shallow and disruptive relationship results in mistrust, less than optimum outcomes, and potentially litigious circumstances.

**Methods and Results:** We have delineated each of these factors and have modified our local environment to address each of these issues and to reverse the adverse effects on patients. The model we have used emphasizes the collaborative benefits of the hospital, the operating room nurse team, the surgeon's office, and the surgeon.

**Conclusions:** The negative effects of the abbreviated surgical experience will only be reversed by conscious effort on the part of surgeons, operating team personnel, and hospital management to reintroduce the patient as the center of attention. Managed care influences will not support improved communication and trust between patients and surgeons.

## Ergonomics for Laparoscopy

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### ABSTRACT

**Objectives:** While the advantages of minimally invasive surgery (MIS) have been clearly established for the patient, the surgeon must cope with disadvantages caused by unergonomic instrument handles. Pressure areas and persisting nerve lesions have been described in the literature. To prevent these it is necessary to use ergonomically designed handles for MIS instruments and to create an ergonomical OR environment.

**Methods:** Anatomical, physiological and ergonomical facts as well as the authors' own experience are presented.

**Results:** An ideal ergonomical working posture for the laparoscopic surgeon and an optimal grasp for manipulating the instruments' functional elements are recommended utilizing physiologic data and the authors' experience. To enable the surgeon to evaluate ergonomical handles for MIS instruments according to his or her own needs, 14 criteria for genuine "ergonomical handles" are established. Some of these are the adjustability for various hand sizes, a one-handed manipulation of all functions, the prevention of pressure areas, and the manipulation of the functional elements with the sensitive areas of the hand.

**Conclusions:** Based on these criteria, deficiencies of handles currently available (ring and shank handles at an angle or with axial extension to the instrument shaft, and pistol handles) are discussed. Furthermore, new handles, developed by the authors according to the criteria for genuine ergonomical handles, are presented.

## Preceptorship Experiences in Minimally Invasive Surgery

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### ABSTRACT

**Objective:** Preceptorships have been used to provide: 1) education for surgeons; 2) credentialing for surgeons; 3) increased experience for surgeons without the disadvantages of the "learning curve;" and 4) education for the minimally invasive surgical operating room team. These assumptions require observations to corroborate the hypotheses.

**Methods:** A single surgeon preceptor (author) performed 495 preceptorship experiences for surgeon-preceptees from January 1994 through April 1998 (52 months). The surgeons were preceptored at 31 separate hospitals. Ninety-six separate surgeons were preceptored. Average number of cases that were preceptored per surgeon was five. Number of months over which surgeons required preceptoring was 3 through 47 months. Eighteen types of advanced and complex procedures were performed.

**Results:** There were no mortalities. There were no serious technical mishaps. In 487 experiences, the surgeon preceptee completed the operative procedure. In eight cases (2%), the procedure was completed by the preceptor. There were six complications (1.5%). Conversion to open procedure occurred in four cases (1%).

**Conclusions:** Preceptorship experiences clearly provide an improved experience for the surgeon preceptee and a margin of safety for the patient. In 495 complex laparoscopic procedures performed using preceptorship concepts, conversion to open procedures was very low (1.0%); risk of complications was also

extremely low (1.5%). However, the preceptor was required to perform the operative procedure in 2% of the cases. Clearly, the preceptor realistically must intervene in specific circumstances. Based on this data, the preceptor should have a license to practice medicine in the state in which the preceptor experience is performed, malpractice coverage should be necessary, and the preceptor should meet the patient preoperatively to ensure informed consent for the preceptor experience.

### Use of Video Assessment to Implement Team Development in Minimally Invasive Surgery

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#### ABSTRACT

**Objective:** Safe, efficient, and successful program development in minimally invasive surgery is dependent upon attention to many factors—the most important being Team Development. Successful team development has been shown to be dependent upon a structured approach to team education, focus on specific educational goals, recognition of various case complexities for the team (as opposed to procedure complexity for the surgeon), participation from key surgeon team “champions,” and the use of appropriate multimedia educational materials.

**Methods:** To this end, we have used multimedia as tools to maximize educational results, and have used video assessments to delineate results and to evaluate the need for improvements in results. This process was utilized during team development in laparoscopic colon-rectal surgery, Nissen fundoplication/gastric surgery, lumbosacral spine surgery, herniorrhaphy, solid organ surgery, and laparoscopic assisted vaginal hysterectomy (LAVH). This process has been used on a regular basis for 42 months during various Procedure Program Development endeavors. Following the procedure, team members assess video review of the choreography of each procedure and evaluate the efficiency and effectiveness of each step. Recommendations for modification and/or change in orchestration of the team are made, and recommendations for change are implemented.

**Results:** Two hundred and ninety cases have been recorded or reviewed in 42 months. Numerous modifications in team development steps for each procedure have been recommended and instituted. Changes have been made which include decrease in personnel manpower required, as well as the use of specific sophisticated technologies to enhance team efficiency.

**Conclusions:** The use of video documentation of the efficiency of the steps and the choreography of the operating room team during minimally invasive surgical procedures 1) provides

detailed documentation of areas of strength, as well as areas requiring improvement; 2) allows objective comparison to the benefits of modifications which are recommended as a result of these evaluations; 3) allows an objective assessment of improvement in a stepwise fashion; 4) delineates progress for team members visually; and, lastly, 5) the visual format maximizes the opportunity for many team players to learn recommended modifications in the choreography of procedures quickly and efficiently.

### SCDs, Are They Really Necessary?

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#### ABSTRACT

**Objective:** The purpose of this study conducted by Geisinger Medical Center, Danville, PA, was to determine if there is an increased incidence of clinically evident deep vein thrombosis (DVT) and pulmonary embolism using ACE bandages compared with sequential compression devices (SCD).

**Methods and Procedures:** A retrospective chart review was done of 358 laparoscopic cholecystectomies performed with patients wearing SCDs during the years 1992-93 and 419 laparoscopic cholecystectomies performed with patients wearing ACE bandages during the years 1995-96 with a minimum of one year follow-up. Patient age, sex, length of operation, length of stay post-op, and clinical evidence of DVT and PE were examined. The cost of the SCD and ACE wraps were also compared.

**Results:** The mean age (49.6 SCD, 50.4 ACE), operating time (97 min, 82 min), length of stay (2.2 days, 1.7 days) and clinical evidence of DVT (1 SCD, 2 ACE) and PE (0, 0) were similar in the two groups. The patient charge for the Kendall SCD was \$188.25 each, and the patient charge for the ACE bandages was \$3.20.

**Conclusions:** There was no significant increase in incidence of clinically evident DVT or PE when using ACE bandages instead of sequential compression devices for laparoscopic cholecystectomies at a cost savings of \$77,535.95 for the years 1995-96.

## Technical Aspects of Pneumoperitoneum: Computer Model for Intraoperative Evaluation during Pelviscopy and Laparoscopy

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### ABSTRACT

**Objectives:** With increasing technology and computerized systems in the OR the physician's responsibility is growing. Better understanding of physical effects of intraoperative insufflation technique and interaction between technique, patient and physician is necessary.

**Methods and Procedures:** For quality control study of potential insufflation problems, a computer-based online data acquisition model was designed. During 73 standard laparo-pelviscopic procedures, gas flow (l/min), pressure (mm Hg) and temperature (°C) were continuously measured at defined points in the insufflation system and patient.

**Results:** The actual physical values measured show a wide range and are often not identical with the insufflator presetting. Some can even question patient security. Results show pressure in the abdomen is usually less than pressure in the system. Intra-abdominal pressure peaks up to 50 mm HG at nominal pressure of 10 mm HG occurred during trocar insertion and other abdominal manipulation. They can push gas or body fluids towards the insufflator and make use of gas filters essential. Negative pressure up to -50 mm HG and flow up to -15 l/min was measured. Gas temperature in the hose equals room temperature. Gas temperature in the abdomen can decrease 8.3°C (from 36.0 to 27.7°C) and body core temperature can drop 1.63°C, especially under high flow, use of large amounts of gas and prolonged period of insufflation. Insufflator internal gas heating proved not to be efficient enough to heat up gas to body temperature. Standard body temperature rewarming devices combined maintained body core temperature.

**Conclusion:** The results demonstrate a need for intraoperative evaluation of insufflation technique for laparoscopy and pelviscopy and document insufflation-related problems. Although no obvious complication related to insufflation problems occurred, the findings potentially question patient security. Further investigation of physical effects and its influence on patient physiology is necessary. This computer-based measurement model has been proven to be useful for quality control study in the OR.

## Database Software for Outcomes Analysis in Laparoscopic Surgery Patient Populations

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### ABSTRACT

**Objectives:** This computer software was designed to provide a powerful and efficient mechanism for cataloging and tracking laparoscopic surgery patients in order to facilitate research and quality assurance.

**Description:** The database consists of three computer screens: Biographical Information, Surgical Information, and Follow-up Information, which ask short focused questions of the patient population enabling expedient entry and review. The software focuses on specific preoperative identifiers, laparoscopic procedures and follow-up studies. Each section may be tailored to enable data collection within a surgeon's area of interest. This system substantially reduces the work of pulling charts, creating patient lists, and performing computations for research.

An offline edition of the database is a smaller, portable version that allows patient entry at multiple offsite locations. Data is then downloaded into the central database providing participating surgeons with a collective information source.

**Requirements:** PKZIP for Windows, Access 97, and Windows 95.

## Prevention of Systemic Hypothermia in Laparoscopy and Pelviscopy with Standard Body Temperature Warming Devices

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### ABSTRACT

**Objectives:** Intraoperative systemic hypothermia is linked to a higher postoperative complication rate. So far, clinical relevance of laparo-pelviscopic hypothermia and potential prevention is controversially discussed; therefore, evaluation of hypothermia and prevention methods are necessary.

**Methods and Procedures:** Intra-abdominal CO<sub>2</sub> gas and body temperature were evaluated during a variety of standard laparo-pelviscopic procedures with different insufflators from 10-20 l/min (BEL, Snowden & Pencer, Storz, Wolf) and body temperature maintaining devices (Bair Hugger® and fluid warmer: Augustine Medical Inc., Eden Prairie, MN; Blanketrol®, Cincinnati Sub-Zero Products, Inc., Cincinnati, OH; blankets). Temperature was measured in insufflation system, abdomen and rectum in 55 consecutive cases (age 18-92 years) in a community hospital in rural Alabama.

**Results:** CO<sub>2</sub> is already at room temperature in the insufflation hose (-22°C, relying on OR air-condition setting). During insufflation, intra-abdominal gas temperature can decrease to 27.7°C (avg. 32.7°C) depending on length of operation (23 min - 5 h 8 min), amount of gas used (12.8 - 801 l), high gas flow (≤ 20 l./min) and leakage rate. However, different insufflator comparison pre-postop showed no decline in rectal temperature (avg. +0.2°C, n=55), because warming equipment used prevented systemic hypothermia.

**Conclusions:** Intraoperative intra-abdominal gas temperature decrease is remarkable, but can be limited by restricting gas flow and leakage rate. In operations > 1 h, body temperature can be maintained with a combination of appropriate heating devices.

## A Safe Reusable Imaging Port, EndoTIP

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### ABSTRACT

**Objectives:** As endoscopic surgery evolves and more sophisticated procedures are performed laparoscopically in high-risk patients, particular attention must be paid to access safety. The purpose of this study is to evaluate the safety of an innovative method and instrument called EndoTIP Endoscopic Threaded Imaging Port.

**Methods and Procedures:** Prospective clinical trial using a 5 and 10 mm EndoTIP. Two-hundred seventy-five consecutive unselected diagnostic and operative laparoscopies were performed and several parameters recorded.

**Results:** (1994-1998) Forty-four percent of the patients had previous pelvi/abdominal surgery; 24% had previous laparoscopies; and 5.1% had more than one laparoscopy. No device- or technique-related complications or failed access attempts were noted. Most of the patients were discharged within 24 hours.

**Conclusions:** EndoTIP offered reusable visual entry and exit and controlled access without use of trocars and without need of perpendicular penetration force. Less tissue trauma was observed, and muscle shutter mechanism seemed better preserved at the access site.

## The Impact of the "Laparoscopic Era" on Resident Experience and Confidence for Treatment of Biliary Tract Disease

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### ABSTRACT

**Purpose:** During a recent national laparoscopic meeting, controversy arose regarding training of surgical residents during the laparoscopic era. In particular, much concern was demonstrated in terms of teaching surgical residents to perform open cholecystectomy and common bile duct exploration safely and efficiently.

**Methods:** In an attempt to delineate changes in resident experience at our institution, a retrospective analysis of cholecystectomies performed during the period of July 1989 to June 1996 was undertaken. Particular attention was given to resident experience in open cholecystectomy with comparison made regarding case distribution patterns in the residency during the periods of 1989-1990 (pre-laparoscopic era) and 1995-1996 (current era). As a follow-up to our own resident experience, a survey was mailed to all graduating chief surgical residents in Pennsylvania (78 per year) for two consecutive years (n=156). Questions asked included the number of open and laparoscopic cholecystectomies and common bile duct explorations (CBDE) performed during their residencies. A measure of the residents' confidence level performing these procedures was also determined. Residents were asked whether their programs provided adequate experience in these techniques.

**Results:** Case distribution data is shown below:

	PG1	PG2	PG3	PG4	PG5
% of open cholecystectomies (1989-90)	1%	16%	34%	29%	18%
% of open cholecystectomies (1995-96)	0%	7%	22%	16%	54%
p=0.0002 (vs. 1995-96)					

Response rates for the mail survey were 40% (n=61). Results show that residents feel they received adequate training and are equally confident performing both open and laparoscopic cholecystectomy. However, they feel inadequately trained in CBDE and believe that the open approach is safer. The volume of cases performed at university and community programs were not significantly different. Residents perform more laparoscopic cholecystectomies than open and more open CBDE compared to the laparoscopic approach.

**Conclusions:** The laparoscopic era has led to dramatic changes

in resident training. The open approach to cholecystectomy is now reserved for difficult cases. Although some extrapolation of laparoscopic technical experience to the open realm is possible, the lack of adequate CBDE experience by graduating residents is very concerning. Residents' concerns about their training must be addressed by surgical educators.

# Chronic Acalculous Cholecystitis: Changes in Patient Demographics and Evaluation since the Advent of Laparoscopic Cholecystectomy

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## ABSTRACT

**Objectives:** To compare patient demographics and evaluation during the decade surrounding the introduction of laparoscopic cholecystectomy (June 1990) for patients undergoing primary cholecystectomy for chronic noncalculous disease of the gallbladder in this relatively geographically isolated community.

**Methods:** Three hundred and one consecutive patients with chronic noncalculous disease of the gallbladder underwent primary cholecystectomy from June 1985 to June 1995. The preoperative evaluation and postoperative course were reviewed, including subsequent hospitalizations, emergency room visits, and office records. Patients with acute acalculous disease were excluded.

**Results:** Of 301 patients, 30% (91) were in the open cholecystectomy (OC) era and 70% (210) were in the laparoscopic cholecystectomy (LC) era. Patients with acalculous disease were significantly ( $p<0.001$ ) younger (mean 45.3 years) compared to patients with cholelithiasis (mean 50.6 years) and in the OC era were significantly ( $p<0.05$ ) younger (mean 42.2 years) than those in the LC era (mean 46.5 years). Eighty percent of patients were female and 85% of patients had private commercial insurance throughout the decade.

Patient use of omeprazole and NSAIDs increased from the OC to the LC eras, while antacid use declined ( $p<0.05$ ). The number of preoperative diagnostic tests decreased from 4.7 in the OC era to 3.2 in the LC era ( $p<0.05$ ). All types of preoperative testing decreased in utilization between the OC and the LC era except hepatobiliary scintigraphy (HIDA) which increased in the LC era due to cholecystokinin (CCK)-stimulated HIDA and ultrasound which remained stable throughout the decade. Twenty-two percent of all patients continued to have symptoms postoperatively, including 2.7% (8) of patients who had elective operations for continued abdominal symptoms within one year of cholecystectomy in both the OC and LC groups.

**Conclusions:** Chronic acalculous cholecystitis treated surgically is a condition increasingly seen in females covered by private

insurance that has doubled in frequency over the decade of review. Fewer preoperative tests are being performed on these patients, with 78% of patients reviewed having resolution of their symptoms.

# Conversion of Laparoscopic Cholecystectomy in Patients with Acute Cholecystitis: Can We Predict It?

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## ABSTRACT

**Objectives:** Laparoscopic cholecystectomy (LC) for acute cholecystitis is associated with a high conversion rate. This study was undertaken to identify pre-operative factors which would identify the need to convert to open cholecystectomy (OC).

**Methods and Procedures:** Between January 1993 and December 1996, 46 patients underwent LC for acute cholecystitis. A retrospective review of patient records was performed. All patients underwent surgery during the initial hospitalization. Trends in temperature, white count and lab parameters were recorded for the period between admission and surgery. Statistical analysis was performed using the chi squared or Fischer's exact test for discrete variables and the independent t test for continuous variables.

**Results:** There were 21 males and 25 females. The mean age was 54 years (range 18 to 81 years). Thirty-seven patients had documented cholelithiasis—29 patients had multiple stones and 8 patients had a single stone. Ten patients (21.7%) required conversion to OC. The mean time to conversion was 68 minutes with a range of 30 to 180 minutes. Nine of the 21 (42.9%) male patients required conversion compared to 1 of the 25 (4%) females ( $p=0.0027$ ). Patients whose white blood cell (WBC) counts trended upwards in the preoperative period required conversion in 2 of 8 patients (25%) compared to 2 of 9 (22%) and 6 of 15 (40%) patients with unchanged WBC counts and decreasing WBC counts, respectively ( $p=0.098$ ). Patients whose Tmax was rising prior to surgery were converted at a higher rate than both the groups with unchanged and decreasing Tmax, 100%, 17% and 60%, respectively ( $p=0.0003$ ). In patients whose LDH showed a rising trend, 2 of 3 (67%) required conversion compared to conversion in 1 of 12 and 5 of 13 patients with unchanged and decreasing LDH levels, respectively ( $p=0.043$ ). Trends for AST, ALT, Total Bilirubin, Amylase and Lipase were not predictive of conversion. There were no complications in patients who underwent successful LC.

**Conclusions:** LC can be safely performed in patients with cholecystitis. Trends in the patient's temperature, WBC, and LDH may

predict the need to convert to OC. These results may affect operative strategy, especially when formulating a cost-effective approach to patients with acute cholecystitis.

## Laparoscopic Cholecystectomy in an Academic Hospital: An Evaluation of Changes in Perioperative Outcomes

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### ABSTRACT

**Objectives:** Evaluate changes in perioperative outcomes over an 82-month period in patients undergoing laparoscopic cholecystectomy by a single attending surgeon in an academic hospital.

**Methods:** A retrospective review of 1,025 consecutive patients undergoing laparoscopic cholecystectomy from September 1992 to February 1997 was compared to the initial 600 patients from May 1990 to August 1992. Statistical analysis included Chi square with Yates correction and Fischer's exact test.

**Results:** Over the 82-month period there were no significant differences in the overall conversion rate to open cholecystectomy ( $p = 0.26$ ), intraoperative complications ( $p = 0.81$ ), postoperative complications ( $p = 0.054$ ) or mortality rates ( $p = 0.66$ ). There were 4 (0.5%) bile duct injuries in the initial 600 patients and only 1 (0.1%) in the group of 1,025 patients. The difference was not significant ( $p = 0.065$ ). However, there was a significant increase ( $p < 0.0001$ ) in laparoscopic cholecystectomies performed for acute cholecystitis in the group of 1,025 patients. Despite this, the conversion rates to open cholecystectomy in patients with acute cholecystitis decreased ( $p < 0.001$ ). The surgery residents were the operating surgeon in a significantly increased ( $p < 0.0001$ ) number of cases in the group of 1,025 patients. Additionally, more patients ( $p < 0.0001$ ) were discharged on the day of surgery in the most recent group.

**Conclusions:** There is a learning curve to performing laparoscopic cholecystectomy for acute cholecystitis. The conversion rate to open cholecystectomy will decline during this time period without a change in intraoperative or postoperative complication rates, mortality rates or bile duct injury rates. Laparoscopic cholecystectomy can be performed safely by surgery residents under the direct supervision of an experienced laparoscopist, without significant changes in perioperative outcomes.

## The Role of CCK-HIDA Scan in the Diagnosis and Treatment of Chronic Acalculous Cholecystitis

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### ABSTRACT

**Introduction:** Patients with chronic acalculous cholecystitis (CAC) present with symptoms suggestive of biliary colic; however, evaluation with ultrasound fails to delineate gallstones. 99mTc hepatobiliary scanning (CCK-HIDA) has been useful in the diagnosis of cystic duct obstruction, but the addition of cholecystokinin (CCK-HIDA) allows the calculation of gallbladder ejection fraction (EF). The diagnosis of chronic acalculous cholecystitis is made in patients without gallstones who have a decreased EF. (The normal range is 50-80%.)

**Methods:** Between January 1985 and December 1997, 31 patients with symptoms of biliary colic and negative hepatobiliary ultrasounds also underwent CCK-HIDA imaging (24 females, 7 males; age 12-76, mean=41). Patients were initially treated with a low-fat diet. When dietary changes failed, cholecystectomy was recommended. Twenty-four patients (77%) underwent cholecystectomy (Group S). Seven patients had symptom improvement or resolution and have been treated non-operatively (Group F). Patients were evaluated regarding duration of symptoms, gallbladder histology and subsequent clinical course.

**Results:** In Group S, gallbladder EF ranged from 0% to 42% (median=20%) compared to a gallbladder EF range of 0% to 47% (median=24%) for Group F (N.S.). At surgery, two patients (8%) were noted to have cholelithiasis. At follow-up (range 0-124 months, median=32 months), 20 of 22 patients with CAC (91%) reported resolution of their preoperative symptoms without any dietary constraints. All patients who did not undergo surgery have remained minimally symptomatic with dietary restrictions.

**Conclusions:** In patients with symptoms of biliary colic but no evidence of cholelithiasis, CCK-HIDA is the diagnostic modality of choice for the diagnosis of CAC. Cholecystectomy leads to symptom resolution in 91% of patients with CAC and should be considered in those patients whose symptoms persist after dietary changes fail.

## Management of Common Bile Duct Stones in the Laparoscopic Era: An Alternative Pathway

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### ABSTRACT

**Objective:** Controversy still exists about the management of choledocholithiasis. While some surgeons advocate routine use

of intraoperative cholangiography during laparoscopic cholecystectomy, other surgeons suggest alternative ways of management. The purpose of this study is to evaluate a modified pathway of management of stones in the common bile duct.

**Methods and Procedures:** Twenty-three patients with gallstone disease are included in this study. All had clinical and/or chemical evidence of bile duct obstruction. For each patient, an abdominal ultrasound was done followed by Magnetic Resonance Cholangiography. Results were compared. Endoscopic Retrograde Cholangiography was then performed, essentially for removal of bile duct stones. If this was successful, laparoscopic cholecystectomy was carried out or else the bile duct was explored in a conventional manner.

**Results:** Ultrasound revealed bile duct stones in 14 patients, while in the rest of patients it was inconclusive. Magnetic Resonance Cholangiography was normal in two patients (i.e., no obstruction found), while it confirmed the presence of biliary obstruction in 21 patients: 19 due to stones and 2 due to other causes. Endoscopic Retrograde Cholangiography was attempted in 21 patients. It was possible to insert endoscopic stents in two patients with malignant obstruction, who needed no further surgery. Stones were endoscopically removed in 17 patients. Laparoscopic cholecystectomy was successfully performed in 19 patients. Open cholecystectomy and bile duct exploration was done in two patients.

**Conclusion:** The use of both Magnetic Resonance Cholangiography and Endoscopic Retrograde Cholangiography prior to surgical intervention in patients with jaundice due to common bile duct stones improves the patients' outcome. They constitute a valid alternative to intraoperative cholangiography and have the advantage of a therapeutic potential.

## The Efficacy of Endoscopic Retrograde Cholangiopancreatography for Gallstone Disease

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### ABSTRACT

**Objectives:** The management of gallstone disease has undergone dramatic changes in the past ten years. The preferred treatment for patients with uncomplicated symptomatic cholelithiasis has become laparoscopic cholecystectomy. This new era has given rise to the debate concerning optimal management of choledocholithiasis, as well as the timing of intervention. Management possibilities range from perioperative Endoscopic Retrograde Cholangiopancreatography (ERCP) to intraoperative common duct exploration by open or laparoscopic technique.

The aims of this study are to 1) further define predictive parameters of choledocholithiasis; 2) determine the indications for ERCP; and 3) evaluate the efficacy and safety of ERCP.

**Methods:** Historical, biochemical, ultrasonographic and ERCP data were collected retrospectively for 234 patients who underwent ERCP between January 1993 to February 1997 for gallstone disease. Patients were then divided into two groups based on ERCP findings. Patients in Group I had choledocholithiasis, and patients in Group II did not. These groups were then analyzed using Wilcoxon's sum of ranks test to determine predictors of choledocholithiasis.

**Results:** One hundred sixty-five patients had choledocholithiasis by ERCP; 69 patients did not. Parameters found to be statistically different between these two groups included total bilirubin ( $p < 0.001$ ), AST ( $p < 0.001$ ), ALT ( $p < 0.001$ ), alkaline phosphatase ( $p < 0.001$ ), and common bile duct diameter by ultrasound ( $p < 0.001$ ). Ninety-two percent of patients with an increased total bilirubin had choledocholithiasis; 87% of patients with an enlarged common bile duct or choledocholithiasis by ultrasound within 72 hours of ERCP had choledocholithiasis; and 61% of patients with an isolated elevation of at least two of the following criteria had choledocholithiasis: AST  $> 100$ , ALT  $> 100$ , alkaline phosphatase  $> 125$ . All patients having choledocholithiasis (group I) met at least one of these three criteria. Parameters with no significant difference included lactate dehydrogenase, age, white blood cell count, hemoglobin, amylase, and lipase. Complications of ERCP were rare (2%) and had no long-term morbidity. ERCP was effective in 98% of cases.

**Conclusions:** Patients with an elevated total bilirubin in the presence of gallstone disease, a dilated common bile duct or choledocholithiasis by ultrasound, or combined enzyme elevations (AST  $> 100$ , ALT  $> 100$ , and/or alkaline phosphatase  $> 125$ ) are at high risk for choledocholithiasis and should have evaluation of their common bile duct by ERCP or other means. ERCP is a safe and effective procedure for management of choledocholithiasis.

## Role of Preoperative ERCP in Patients Undergoing Laparoscopic Cholecystectomy

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### ABSTRACT

**Objective:** The need for cholangiography during laparoscopic cholecystectomy remains controversial, and two competing strategies have emerged. Some advocate routine intraoperative cholangiography to define anatomy and to minimize unnecessary endoscopic retrograde cholangiopancreatography. Others (our institution included) rely upon selective preoperative endoscopic retrograde cholangiopancreatography to screen patients for (and

treat) common bile duct pathology. Potential problems with this approach are the risks, on the one hand, of performing unnecessary endoscopic retrograde cholangiopancreatography and, on the other hand, of overlooking common bile duct pathology.

**Methods and Procedures:** To assess the efficacy of our institution's approach, we retrospectively reviewed charts of patients undergoing cholecystectomy between January 1 and December 31, 1996.

**Results:** Of 206 patients undergoing completed laparoscopic cholecystectomy, 33 (16%) had preoperative endoscopic retrograde cholangiopancreatography. Indications for preoperative endoscopic retrograde cholangiopancreatography were pancreatitis (12 patients), elevated bilirubin (19), elevated alkaline phosphatase (19), elevated transaminase (25), dilated common bile duct (4), and common bile duct stone (3 patients). At preoperative endoscopic retrograde cholangiopancreatography, 12 patients had a common bile duct stone, 1 each common bile duct sludge, or common bile duct dilatation without common bile duct stone. Two studies were unsuccessful and 16 (52%) were normal. Patients with pathology underwent sphincterotomy.

No patient had intraoperative cholangiography or common bile duct exploration.

Twenty-eight (14%) patients were readmitted within one year: 6 for surgery-related complications; 7 with biliary tract disease, and 15 for unrelated reasons. Eleven patients underwent postoperative endoscopic retrograde cholangiopancreatography, none of whom had had preoperative endoscopic retrograde cholangiopancreatography. Indications for postoperative endoscopic retrograde cholangiopancreatography were pancreatitis (1 patient), elevated bilirubin (7), elevated alkaline phosphatase (9) and pain (4). Two studies revealed cystic duct leaks, and 1 each sludge, papillary inflammation, common bile duct stricture, and common bile duct injury. Two had common bile duct stone. One was normal and one was unsuccessful.

**Conclusions:** Because only two patients with a common bile duct stone found on postoperative endoscopic retrograde cholangiopancreatography represent common bile duct pathology possibly overlooked at surgery, we conclude that selective preoperative endoscopic retrograde cholangiopancreatography effectively identifies and treats common bile duct pathology associated with cholelithiasis.

## Laparoscopic vs. Open Cholecystectomy for Gangrenous Cholecystitis

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### ABSTRACT

**Objective:** The role of laparoscopic cholecystectomy in gangrenous cholecystitis remains poorly defined. This study was

designed to compare outcomes in patients undergoing laparoscopic vs. open cholecystectomy for gangrenous cholecystitis.

**Materials and Methods:** A retrospective view of all patients with a pathologic diagnosis of gangrenous cholecystitis between January 1994 and January 1998 was performed. Statistical analyses comparing operative time, postoperative morbidity and hospital stay were performed using one-way ANOVA and Fischer's Exact Test.

**Results:** Of the 44 patients who met the study criteria, there were 22 males and 22 females, with a mean age of 65.8 years (range 32-97 years). An initial laparoscopic approach was adopted in 35/44 (79.5%) and was successfully completed in 23/35 (65.7%). Conversion to an open procedure was necessitated in 12/35 (34.3%). Open cholecystectomy was the initial approach in 9/44 (20.5%). Severe adhesions from previous surgery and friability of the gallbladder were the most frequent reasons for conversion. Average duration of surgery was 97, 109, and 108 minutes in the open, conversion and laparoscopic groups, respectively ( $p=0.65$ ). Postoperative morbidity occurred in 26/44 (59%) of patients: 8/9 (89%) of the open group, 9/12 (75%) of the conversion group and 9/23 (39%) in the laparoscopic group ( $p=0.01$ ). Mean postoperative hospital stay was 9.3, 5.5, and 3.4 days for the open, conversion and laparoscopic groups, respectively ( $p<0.001$ ).

**Conclusions:** Laparoscopic cholecystectomy is feasible as the initial operative approach in the majority of patients with gangrenous cholecystitis. No statistically significant difference in duration of surgery was observed between the three groups. Successful laparoscopic cholecystectomy is associated with a significantly lower morbidity and a shorter postoperative hospital stay.

## The Case of the Missing Clips

Michael Fenoglio, MD, Michael Alberts, MD

### ABSTRACT

**Objectives:** The purpose of this presentation was to present a case of clip migration into the common bile duct following laparoscopic cholecystectomy and laparoscopic common duct exploration resulting in common duct obstruction.

**Methods and Procedures:** This is a 52 year old gentleman who presented in February 1995 with symptoms of biliary colic and elevated liver function studies. Workup at that time included an ultrasound which revealed cholelithiasis and a dilated common duct. He was taken to the operating room for a laparoscopic cholecystectomy and plans for an intraoperative cholangiogram. At the time of surgery, a dilated common duct and distal common duct stone were identified. He underwent a laparoscopic common duct exploration via a choledochotomy and had successful removal of the stone. A T-tube was inserted into the common



duct and sutured into place. The T-tube was removed on post-operative day 14, and the patient had an uneventful recovery. In April 1997, approximately two years after his original surgery, he presented with a four to six month history of intermittent vague right upper quadrant pain and slightly abnormal liver function studies. An ultrasound at the time revealed a dilated common duct. An Endoscopic Retrograde Cholangiopancreatography (ERCP) was unsuccessful because of a large duodenal diverticulum, and he subsequently had an attempt at a percutaneous transhepatic cholangiogram (PTC). However, because of lack of patient cooperation, this could not be completed. One x-ray was obtained, however, and there was some question about clip migration. On the evening of the attempted PTC, the patient presented with abdominal pain and had a CT scan to rule out a bile leak. At that time it was noted there was a metallic object inside the common duct at the head of the pancreas three days later. The patient was then taken to the operating room and an ERCP and sphincterotomy were performed. However, the clips at this time were noted to have migrated approximately into the left hepatic duct, and we were unsuccessful at removing them at this time. It was elected not to open the patient, and on subsequent follow-up films the clips were shown to no longer be present in the common duct and presumably passed in the stool.

**Conclusions:** Foreign bodies or phytobezoars are not uncommon in the bile duct, either isolated or as a nidus for common duct stones in patients with previous biliary enteric anastomosis or sphincterotomy. This case represents migration of clips used to control the cystic duct stump into the common duct resulting in biliary tract obstruction. While this is a relatively rare complication following laparoscopic surgery, it is one that all surgeons should be aware of. A review of the world's literature on this subject will also be performed.

## Laparoscopic Electro-Dynamic Cholecystectomy

Salah A. Al Khuwaitir, MD

### ABSTRACT

**Objectives:** The laparoscopic electro-dynamic cholecystectomy procedure (LEDC) has now been well established in the King Khaled University Hospital, Riyadh, Saudi Arabia. The objective of the study was to reaffirm the safety of this novel alternative of traditional cholecystectomy.

**Methods and Procedures:** The study population was 115 patients (111 females and 4 males) admitted to our service with biliary colic. These patients underwent LEDC as described in the *Journal of Medical Science and Research* 1997:25,425-427. The patients were evaluated for postoperative complications, successful healing, symptoms upon follow-up, and average hospital stay.

**Results:** The results showed that one (0.87%) patient had intestinal injury, one (0.87%) had toxemia and died, two (1.74%) had

bleeding due to a perforated ulcer, one (0.87%) had a biliary fistula, and one (0.87%) had clipping of the right hepatic duct. Successful healing was achieved in 102 (88.7%) graded very good, in nine (7.83%) with a grade of good, while two (1.74%) had a grade of poor, and two (1.74%) had a grade of very poor. At follow-up, 50 (43.48%) patients were asymptomatic at three months while seven (6.09%) patients were symptomatic. At six-months follow-up, there was no significant change in the ratio of symptomatic to asymptomatic patients—45.22% versus 5.22%, respectively. The average hospital stay was 1-2 days.

**Conclusions:** LEDC was found to be safe, efficient and comparing well, if not better, with results obtained by the traditional method. We believe it to be the procedure of choice in the future.

## Laparoscopic Cholecystectomy during Pregnancy: Three Case Reports

Themis Chamogeorgakis, MD, Brand Feuerstein, MD,  
Edward Brennan, Jr., MD, Robert Smink, Jr., MD

### ABSTRACT

**Objective:** The purpose of this presentation is to investigate the effects and feasibility of laparoscopic cholecystectomy during pregnancy.

**Methods and Procedures:** We present three pregnant patients who underwent laparoscopic cholecystectomy for biliary colic during the early second and early third trimester of pregnancy. We also reviewed the literature regarding this topic.

**Results:** All three pregnant patients had uneventful hospital courses after their procedures and delivered full-term babies without complications. Laparoscopic cholecystectomy during the first trimester of pregnancy is contraindicated due to the ongoing fetal organogenesis and during the third trimester is not technically feasible due to the large uterine size.

**Conclusions:** We conclude that laparoscopic cholecystectomy during the second and very early third trimester of pregnancy is safe and feasible.

## Laparoscopic Cholecystectomy and Appendectomy in Visceral Situs Inversus Totalis

Risal S. Djohan, MD, Mohammed F. Ziauddin, MD,  
James A. Unti, MD, Francis J. Podbielski, MD

### ABSTRACT

Visceral situs inversus totalis is a rare autosomal recessive condition with an incidence of 1:20,000 in the normal population. Patients with intra-abdominal pathology and this condition present a confusing clinical picture to the evaluating physician. Delay in diagnosis often occurs due to atypical symptomatology of common abdominal problems.

We report the case of a 22 year old female presenting to the emergency room for the third time with recurrent, postprandial left upper quadrant pain associated with nausea and emesis. Physical examination was remarkable for the point of maximal cardiac impulse over the right chest, and abdominal tenderness with guarding in the left upper quadrant.

Chest radiography demonstrated dextrocardia, and abdominal ultrasonography showed a left-sided liver and gallbladder with cholelithiasis and dilated intra- and extrahepatic biliary ducts.

A standard laparoscopic cholecystectomy was performed with mirror image port placement. The intraoperative cholangiogram showed no choledocholithiasis. An incidental appendectomy was also performed given the anomalous location of the vermiform appendix in the left mid-abdomen. The patient recovered uneventfully and was discharged home on postoperative day number two.

Laparoscopic exploration, cholecystectomy, and appendectomy can be safely and reliably performed in patients with visceral situs inversus.

## Laparoscopic Management of Gallbladder Duplication

John Maddox, MD, Marc Demers, MD

### ABSTRACT

**Introduction:** Congenital duplication of the gallbladder is rare. The incidence of duplication is 1 in 3,000-4,000. We present the second case of gallbladder duplication not suspected preoperatively, which was treated successfully by laparoscopic cholecystectomy.

**Case Report:** A 52 year old woman presented with several episodes of biliary colic. Gallbladder sonogram demonstrated cholelithiasis. Preoperative scintiscan revealed normal visualization of the liver, gallbladder, bile duct, and duodenum. After laparoscopic identification and transection of the primary cystic duct and artery, a saccular structure was seen to be adherent to

the hepatic bed and the hepatic aspect of the first gallbladder. Using scissor dissection, the plane between the two structures was created. The primary gallbladder was removed using cautery. The saccular structure terminated in a cystic duct, which was clipped and transected. The saccular structure was then removed. No associated artery was identified. Pathology demonstrated chronic cholecystitis in both organs. The patient was discharged as an outpatient, and her recovery was uneventful.

**Conclusions:** Gallbladder duplication can be safely removed laparoscopically without cholangiography if certain criteria are met. Cystic duct transection is safe following the identification of the cystic duct-infundibulum junction, regardless of the proximal anatomy of the cystic ducts and common bile duct(s). It is not necessary to radiographically demonstrate the ductal anatomy to remove either organ.

## Laparoscopic Cholecystectomy in Patients with Bilharzial Portal Hypertension

Salam M.A. Isam, MD, Abu Azab Ismail, MD,  
Ibnoaf Mohamed, MD, Fedail S. Suliman, MD

### ABSTRACT

**Objectives:** The purpose of this study, conducted in Al Ain and Khartoum hospitals over the past four and a half years, is to evaluate the results of laparoscopic cholecystectomy in patients with gallstones and bilharzial portal hypertension. Open cholecystectomy on this group of patients carries increased morbidity and mortality.

**Methods and Procedures:** Patients who had gallstones and history of bilharzia had endoscopy, assessment of periportal fibrosis by ultrasonography, hemagglutination test and rectal snip. Operating time during laparoscopy was recorded. Blood loss, hospital stay, time of return to work and operative mortality were recorded.

**Results:** Twenty-five out of 450 patients who had laparoscopic cholecystectomy suffered from bilharzial portal hypertension. Ten patients had grade 1 varices, ten had grade 2 and five patients had grade 3 esophageal varices. All patients had varying degrees of periportal fibrosis as proved by ultrasound. Rectal snip showed schistosoma Mansonii in five patients and hemagglutination test was positive (1/64 dilution) in all. Two patients had conversion to open cholecystectomy. Mean operating time was 1 hour 15 minutes. Average blood loss in laparoscopy was less than 50 cc. Mean hospital stay for non-complicated patients was less than 48 hours. Average time of return to work was two weeks in 23 patients and six weeks in the 2 patients who had conversion. There was no mortality in this series.

**Conclusions:** Laparoscopic cholecystectomy in patients with bilharzial portal hypertension has low morbidity and carries no mortality.

## **Biliary Disease: A More Virulent Process in Males**

Leena Khaitan, MD, Edward J. Brennan, Jr., MD

### **ABSTRACT**

**Objectives:** Laparoscopic cholecystectomy has become the standard of care for symptomatic cholelithiasis and acute cholecystitis. However, there is a percentage of the time where the cholecystectomy must be converted from laparoscopic to an open procedure. Conversion occurs in male patients much more frequently than in females.

**Methods and Procedures:** At the Lankenau Medical Center we retrospectively reviewed 233 consecutive cholecystectomies performed between January 1997 to February 1998. There were 65 male and 168 female patients.

**Results:** Thirty-eight patients (16.3%) were converted from a laparoscopic to an open procedure. What is interesting about this group of patients is that the percentage of male patients (41.5%) converted to an open procedure was three times as high as female patients (6.5%) undergoing an open procedure.

**Conclusions:** We contend that gallbladder disease is a much more virulent process in males with a much higher percentage of male patients requiring conversion to open procedure.

## **Comparison of Laparoscopic Hernia Repair to Modified Shouldice Repair**

Thomas Nicholson, MD, V. Tiruchelvam, MD

### **ABSTRACT**

**Objectives:** The purpose of this study was to compare the laparoscopic versus open modified Shouldice technique in inguinal hernia repair. The laparoscopic repair allows patients to recover faster with less pain; however, disadvantages are the more expensive charge and longer surgical time. Therefore, is the laparoscopic method cost-effective?

**Methods:** We conducted a retrospective study involving patients undergoing inguinal hernia repair over a two-year period. All patients had surgery performed by the same surgeon at the same institution. Eighty-five males were included, 45 undergoing preperitoneal laparoscopic repair and 40 undergoing the modified Shouldice procedure. Part one involved a patient interview evaluating degree and duration of pain, and days to return to activities, work, and athletics. Results were statistically evaluated with Mann-Whitney and t-test comparisons.

**Results:** Patients undergoing laparoscopic repair had longer surgical time by 29.38 minutes, longer recovery room time by 69.08 minutes, and a higher charge of \$1218.59 than open repair. Laparoscopic repair patients returned to activities 2.29 days sooner, returned to work 11.10 days earlier, and resumed athletics 6.91

days faster than with open repair. Laparoscopic patients had less pain which resolved sooner, but was not statistically significant.

**Conclusions:** Patients undergoing laparoscopic hernia repair returned to work, activities, and athletics sooner than patients undergoing a modified Shouldice technique. The results showed a higher charge for the laparoscopic procedure with longer surgical and recovery room time. The more rapid return to work and activities may outweigh the longer surgical time and charge.

## **Laparoscopic Inguinal Herniorrhaphy: Results of 1,000 Consecutive Repairs**

Bruce Ramshaw, MD, David L. Young, MD

### **ABSTRACT**

This retrospective review evaluates the last 1,000 laparoscopic herniorrhaphies performed at one community-based teaching hospital.

Between August 1995 and January 1998, 1,000 laparoscopic inguinal herniorrhaphies were performed. The patient population included 897 males and 103 females with an average age of 48 years old. There were 137 recurrent and 863 primary hernias repaired. The total extraperitoneal approach was used as the initial approach in all cases. These cases are reviewed after an experience of over 600 laparoscopic hernia repairs that have resulted in the current technique used on these 1,000 consecutive hernia repairs.

The results show that there were no complications or mortality. Minor complications included urinary retention (24), overnight stay due to other medical problems or nausea/vomiting (14), and seroma requiring aspiration (2). There have been two recurrences identified to date with a mean follow-up of 16 months. The cause of recurrence included a small indirect recurrence through the keyhole of the mesh and another indirect recurrence from the lateral flap of mesh folding over due to inadequate fixation.

With experience, a technique of total extraperitoneal approach for laparoscopic hernia repair has been developed, which has resulted in few minor complications, no major complications and a very low recurrence rate over 1,000 consecutive hernia repairs.

## **Preperitoneal Laparoscopic Herniorrhaphy: Lessons Learned from 1000 Hernia Repairs**

Lisa Bellin, MD, Alan Schuricht, MD

### **ABSTRACT**

**Purpose:** Laparoscopic cholecystectomy, after its introduction in the late 1980's, gained rapid acceptance worldwide. Although laparoscopic herniorrhaphy has not enjoyed this quick accept-

ance as the "gold standard" for hernia repair, it continues to gain popularity as an alternative approach for some, if not all, groin hernias. There are numerous publications in the literature discussing recurrence rates and complications, but few of these are technically oriented.

**Methods:** The personal experience of a single surgeon with over 1000 preperitoneal herniorrhaphies will be presented.

**Results:** Emphasis will be given to technical pearls and perils, including patient selection, choice of anesthesia, identification of structures, mesh placement considerations, postoperative patient instructions and patient recovery. Also presented will be patient follow-up, including short- and long-term results, patient recovery profiles, and recurrence rate.

**Conclusions:** Laparoscopic herniorrhaphy is becoming more accepted as a method of groin hernia repair. With proper attention to anatomic considerations and technical aspects of the repair, results and patient satisfaction are excellent.

## Mesh with Slit and Doorflap for Extraperitoneal Hernioplasty

G. Lepsien, MD, A. Zayed, MD, A. Arafa, MD,  
M.A. Al-Jarallah, MD

### ABSTRACT

**Introduction:** After introducing extraperitoneal hernia repair, we operated upon 50 patients with groin hernia (23 R, 16 L, 11 bilateral) from October 15, 1996 to November 30, 1997. Those first 50 patients done by extraperitoneal approach are the reason to describe our special technique and to report the results.

**Methods:** Using an extraperitoneal approach and a balloon for space creation, we dissected the hernia sac, the spermatic cord structures and the surrounding abdominal wall and the pelvic area. After introducing the specifically designed polypropylene mesh (15 x 13.5 cm), we placed it in all patients with the spermatic cord passing the vertical slit. Under the spermatic cord we kept minimum 4 cm mesh without slit. Following proper mesh positioning, we covered the slit by a pre-attached doorflap (8 x 6 cm). No staples were used.

**Results:** There were no intraoperative complications or conversions, although a peritoneal gas leakage happened in 12 patients. Eighty percent of the patients left the hospital the day after surgery, 20% stayed one or two days longer. In the early follow-up, we saw three seromas and three cord swellings. There was groin/scrotal pain in four patients. Pain settled down in three patients and persisted inconstantly in one patient. All patients were included in our follow-up protocol and came on a regular basis. Our last control in the beginning of March 1998 showed that there was no recurrence. Ultrasound confirmed proper unchanged mesh position.

**Conclusions:** Our mesh size offers the needed overlapping. The mesh with slit and doorflap guarantees an anatomical-based position. Wrong positioning is impossible. The spermatic cord keeps the mesh in place and prevents moving. The doorflap covers the weakening slit and adds mesh stability. Our technique is staple free, which helps reduce costs and the risk of nerve trapping. These early results are quite encouraging to indicate our technique in cases of bilateral and recurrent hernias and patients older than 20 years with direct and huge indirect primary hernia.

## Recurrences in Laparoscopic Incisional Hernia Repairs

Richard H. Koehler, MD, Guy Voellers, MD

### ABSTRACT

**Objectives:** Laparoscopic repair of ventral and incisional hernias via transabdominal Gore-Tex DualMesh patch technique continues to evolve, with variable reporting of recurrence rates and lengths of stay. The authors discuss factors associated with recurrences in reviewing a personal series of 30 cases.

**Method:** Retrospective review of 30 consecutive cases with one recurrence.

**Results:** Thirty patients (14 female, 16 male), with 27 incisional hernias, 2 epigastric hernias and 1 umbilical hernia underwent laparoscopic repairs: Average age - 55 years (27-74), average weight - 190 lbs (100-260, mean - 210). Seventeen patients (56%) were undergoing first-time repairs of incisional hernias; seven (23%) had one failed repair, two (6%) had two failed repairs and one patient had three previous repairs. Operating times averaged 97 minutes (45-220), and average length of stay was 0.76 days, with 11 patients being discharged as same-day surgery. One recurrence developed (3%) six months after repair. In analyzing the technique, suspension stay-sutures described by Voellers, et al. had been omitted due to small size of the defect. On repair, done laparoscopically, the mesh had migrated into the defect, having failed to achieve fixation.

**Conclusions:** The laparoscopic repair of ventral and incisional hernias utilizing the transabdominal DualMesh patch can achieve excellent results with low morbidity in comparison with open surgical approaches. In reviewing the experience of other investigators, adequate fixation of the mesh and standardizing the placement interval of the sutures are critical to the success of the repair.

## A Technique for Laparoscopic Repair of Ventral Hernia

Larry H. Stevens, MD, Lori A. Wainscott, RN

### ABSTRACT

**Objective:** The objective of this presentation is to provide a detailed description of the technique, currently being evaluated in a prospective fashion, for the repair of ventral or incisional hernias.

**Methods and Procedures:** Access is gained to the peritoneal cavity using an optical, blunt-tipped trocar, placed under direct laparoscopic control. The initial entry site is placed as far lateral to the hernia as possible; 5.0 mm working ports are then "triangulated" around the scope site. An angled laparoscope is used to improve visualization of the anterior abdominal wall. Adhesions are then divided with a careful sharp dissection, avoiding the use of monopolar electrocautery in proximity to the bowel. Once the hernia defect has been defined, a dual-mesh polytetrafluoroethylene (PTFE) patch is trimmed such that the diameter of the patch is 4.0 to 6.0 cm greater than the diameter of the hernia defect. The PTFE patch is then anchored to the abdominal wall with interrupted sutures placed at the "points of the compass." These interrupted sutures are placed through the patch prior to the introduction of the patch into the abdominal cavity. The sutures are then pulled through the abdominal wall with a trocar closure device. The remainder of the patch is then circumferentially anchored with titanium corkscrew tacks. A circle of tacks is placed at the periphery of the patch, while a smaller circle of tacks is placed more centrally to increase the contact between the abdominal wall and the underlying patch.

**Results:** There have been no conversions to an open operation to date. The most common complication has been transient seroma formation. There have been no bowel injuries. There has been one recurrence and one bladder injury. There have been no perioperative mortalities.

**Conclusion:** Laparoscopic repair of incisional hernias appears to be a viable technique with complication and recurrence rates that appear comparable to open procedures, given the limited follow-up to date.

### Laparoscopic Ventral Herniorrhaphy

Bruce Ramshaw, MD, David L. Young, MD

### ABSTRACT

This study retrospectively reviews 49 consecutive laparoscopic ventral hernia repairs at a single community-based teaching hospital to evaluate the safety and effectiveness of this technique.

Between October 1995 and February 1998, 49 consecutive

laparoscopic ventral hernia repairs were performed. The patient population included 31 females and 18 males with an average age of 43 years old. Twenty-five of the ventral hernia repairs were for recurrence with an average of 2.3 previous open repairs (range 1-6). The technique for laparoscopic ventral hernia repair included initial diagnostic laparoscopy with lysis of adhesions or reduction of hernia contents as needed. A large piece of polytetrafluoroethylene (PTFE) was used to provide coverage of at least 3 cm beyond all defects. The mesh was secured with tacks and/or suture.

The results revealed that there were five minor complications, two major complications and no mortality. The two major complications included one unrecognized bowel injury that required reoperation and mesh removal. The other major complication included an abscess close to the mesh that resolved with CT drainage and intravenous antibiotics without mesh removal. There has been one recurrence in a patient early in the series. The recurrence occurred at the superiolateral aspect of the mesh and may have been due to inadequate mesh fixation.

In conclusion, the early results of laparoscopic ventral herniorrhaphy show a very low recurrence rate with acceptable morbidity and mortality.

## Laparoscopic Repair of Recurrent Ventral Hernia

Todd B. Heniford, MD, Keith Gersin, MD,  
Marjorie Arca, MD, Michel Gagner, MD

### ABSTRACT

Ventral hernias occur in 3-13% of patients following laparotomy. The optimal operative repair of these hernias has yet to be determined. Our group demonstrates the laparoscopic management of a three-time recurrent ventral hernia, with excellent early results.

## Preoperative Expandable Metal Stent as a Nutritional Bridge to Esophagectomy

Ninh T. Nguyen, MD, Tracey L. Weigel, MD,  
James D. Luketich, MD

### ABSTRACT

**Objectives:** Patients with esophagus cancer frequently present with dysphagia, weight loss and varying degrees of malnutrition which can be exacerbated during neoadjuvant therapy. Conventional approaches to nutritional repletion include surgical feeding tubes for enteral feeds or parenteral nutrition. Expandable metal stents have proven to be safe and effective, and they improve quality of life in patients with inoperable, obstructing esophagus cancer but have not been employed when

resection is being considered. The objective of this report was to review our initial experience using expandable metal stents in the preoperative setting to relieve dysphagia and improve nutritional status in patients with operable esophagus cancer.

**Methods and Procedures:** From January 1997 to March 1998, uncovered expandable metal stents (Ultraflex, Boston Scientific Corporation) were placed in ten patients with operable, obstructing esophageal cancer. The mean age was 63 years. Dysphagia score was assessed before and after stent placement (1 for no dysphagia to 5 for complete obstruction).

**Results:** Metal stents were placed prior to initiation of chemotherapy in seven patients and during chemotherapy in one. Two patients underwent esophagectomy three weeks following esophageal stent placement (1 patient refused chemotherapy and 1 with NO disease at laparoscopic staging). Nine patients had resectable stage III distal esophageal cancer (8 adenocarcinoma and 1 squamous), and one patient had stage II disease. There was a significant reduction in dysphagia score from  $3.4 \pm 0.7$  to  $1.3 \pm 0.5$  STD four weeks post-stent deployment ( $p < 0.05$ ) allowing a soft regular diet without additional nutritional supplementation. Post-procedural complications included bleeding and tumor overgrowth in one patient requiring insertion of a second stent, and food impaction in another. Nine patients underwent successful esophagectomy, and one patient had unresectable disease. The mean interval between stent placement and esophagectomy was  $61.2 \pm 38.8$  STD days. Moderate periesophageal fibrosis was present but did not prolong operative time or increase surgical complications.

**Conclusions:** This preliminary experience suggests that expandable metal stents are safe and allow prompt return of oral nutritional intake in patients with obstructing esophagus cancer undergoing chemotherapy while awaiting resection. Further studies are necessary to compare the cost-effectiveness and quality of life issues using expandable esophageal stent as a bridge to esophagectomy compared to traditional invasive feeding tubes or total parenteral nutrition (TPN).

## Laparoscopic Highly Selective Vagotomy (HSV) as a Component of Nissen Fundoplication

Constantinos Stratoulas, MD, W. Peter Geis, MD,  
G. Kevin Gillian, MD, Marcus Berry, MD

### ABSTRACT

**Objective:** The purpose of this study is to identify the indications, describe the technique and present the outcome of laparoscopic highly selective vagotomy in patients undergoing a laparoscopic antireflux procedure. Our hypothesis is that performance of an acid-reducing procedure in combination with the Nissen fundoplication will eliminate the need for continued medical

therapy postoperatively in patients with combined peptic ulcer disease and gastroesophageal reflux disease (GERD).

**Methods and Procedures:** During a three-year interval (1995-98), we treated 240 patients with gastroesophageal reflux disease. We identified a subset of 15 patients (6.1% of patients with GERD) that had proven peptic ulcer disease by endoscopic findings. These patients were found to have a healed or active duodenal or prepyloric ulcer that was proven by endoscopy and were maintained on H2 blockers or proton pump inhibitors. All these patients underwent a laparoscopic highly selective vagotomy at the time of the antireflux operation. Two of these patients also manifested delayed gastric emptying and, in this subset, we also performed a laparoscopic pyloroplasty as a drainage procedure. The average age was 43 years (range 26-63 years). There were eight males and seven females. The nerve of Latarjet and the level of the crow's foot were identified and marked with an endoloop at the lesser omental fat. Dissection with an ultrasonic scalpel was then started at that level dividing serially all the branches of the anterior vagus nerve to the lesser curve of the stomach. This dissection was continued under the cardia to the greater curve to divide the branches of the posterior vagus nerve and also for a few centimeters onto the esophagus to divide the "outriders" (branches of the vagus nerves to the cardia of the stomach emanating from higher on the esophagus). Next, a floppy Nissen fundoplication was performed in the usual fashion.

**Results:** There were no mortalities and no reoperations or conversions to an open procedure. The only morbidity was prolonged ileus in a patient who required prolonged hospitalization (7 days). The average operating time was 2 hours 38 minutes. The operative times improved as familiarity with the procedure increased. In 1995-96, the average operative time was 3 hours and 18 minutes and during 1997-98 the average was 2 hours and 5 minutes. Hospital stay was 2-7 days and estimated blood loss averaged 50 cc. There was no incidence of dumping, diarrhea, bloating, or gastric atony. All patients were weaned off medical therapy between two and four weeks postoperatively. On follow-up, no symptoms of peptic ulcer disease have been reported to date and no active ulcers have been found on follow-up endoscopy.

**Conclusions:** Laparoscopic highly selective vagotomy as a component of an antireflux procedure is indicated in patients with combined peptic ulcer disease and GERD. It eliminates the need for continued medical therapy in this subset of patients, without added morbidity. The technical aspects of laparoscopic highly selective vagotomy as described above need some familiarity by the surgeon, but after the learning phase, it does not add significantly to the operative time of the antireflux procedure.

## The Association of GERD with Other GI Motility Disorders

Larry H. Stevens, MD, Lori A. Wainscott, RN

### ABSTRACT

**Objectives:** The purpose of this study is to describe an apparent association between gastroesophageal reflux disease and the presence of other GI motility disorders, such as irritable bowel syndrome, which complicate the patient's selection for laparoscopic fundoplication and have significant implication for the results of antireflux procedures.

**Methods and Procedures:** Three illustrative case examples will be reported to demonstrate a possible association between gastroesophageal reflux disease and other GI motility disorders.

**Results:** *Case 1:* An adult female with gastroesophageal reflux disease and dysphagia. However, no stricture was seen upon upper GI endoscopy. The patient underwent laparoscopic Nissen fundoplication at an outside institution and developed intractable dysphagia requiring conversion to a Toupet fundoplication. This case highlights the association of gastroesophageal reflux disease with esophageal hypomotility and emphasizes the need for preoperative esophageal manometry studies.

*Case 2:* Adult male with gastroesophageal reflux disease, normal esophageal motility, and normal upper GI endoscopy. Postoperatively, the patient developed severe gas-bloat syndrome, which within months was followed by the development of recurrent reflux. Repeat upper GI evaluation revealed partial breakdown of the fundoplication. Subsequent gastric emptying studies revealed a marked delay in the patient's gastric emptying. He subsequently underwent repeat fundoplication with concomitant pyloroplasty. This case illustrates the association of gastroesophageal reflux disease with gastroparesis.

*Case 3:* Adult female with gastroesophageal reflux disease and a history of irritable bowel syndrome. Esophageal motility was normal preoperatively. However, the patient developed severe gas-bloat syndrome postoperatively. This case again illustrates the association of gastroesophageal reflux disease with irritable bowel syndrome.

**Conclusion:** Gastroesophageal reflux disease is known to involve a motor dysfunction of the GI tract, specifically a deficiency in the lower esophageal sphincter. This report describes that GERD is occasionally associated with other GI motility disorders. Care should be taken in the preoperative evaluation of patients with reflux disease to assure that other motility disorders are not present, which may compromise the results achieved with fundoplication.

## Laparoscopic Giant Hiatal Hernia Repair: Technique, Risks and Benefits

W. Peter Geis, MD, Marcus Berry, MD,  
G. Kevin Gillian, MD, Constantinos Stratoulis, MD

### ABSTRACT

**Objectives:** Laparoscopic repair of giant hiatal hernias, types II and III, has provided a solution to the difficult visualization, high morbidity and high mortality of the open procedure. In this study we have identified the risk factors which should be evaluated preoperatively; we have also described the important technical details. The benefits of the laparoscopic approach are delineated.

**Methods and Procedures:** During a four-year period (1994-98) we performed 23 laparoscopic giant hiatal hernia repairs. The average age was 63 years (range 35-85 years). There were 12 males and 11 females. Because of the advanced age of most of these patients, most underwent preoperative cardiac evaluation. At least two thirds of the stomach should be in the chest cavity through the esophageal hiatus to characterize these as giant hernias. All hernias were symptomatic, with the most common symptoms being obstructive (dysphagia, vomiting, regurgitation, inanition); retrosternal pain (mainly postprandial); anemia; and the least common being acid reflux. During the operative procedure, pediatric thoracostomy tubes should be available to treat possible tension pneumothorax. During the operative procedure, the safest and most efficient method to reduce the hernia contents is associated with incision of the entire sac along the crura followed by dissection and separation of the sac from the mediastinal areolar tissue, and reduction of the hernia contents and the sac into the abdomen simultaneously. This dissection is aided by positive pressure pneumoperitoneum which separates the sac from mediastinal soft tissues and aids in pushing the sac into the abdomen. The crura are closed posteriorly and the resultant hiatus is 3.5 cm diameter (measured). Mesh should be available to reinforce the hiatus closure. (However, we have not required use of the mesh.) An associated gastropexy is occasionally used in order to maintain proper geometric relationships for the intra-abdominal stomach—which is often floppy and tortuous.

**Results:** The average operating time was 3 hours 39 minutes (range 2 hours 30 mins - 6 hours). The average hospital stay was four days. We had one mortality due to massive postoperative myocardial infarction in the recovery room in an 85 year old female patient. Two patients had intraoperative tension pneumothorax with sequelae. One patient had an esophageal leak which was successfully treated non-operatively. There was no morbidity in the remaining patients. They have been asymptomatic on follow-up from four months to four years; no recurrences have occurred. Mesh was never required to close the defect.

**Conclusions:** Laparoscopic repair of giant hiatus hernias is an efficient and safe operative procedure. The laparoscopic approach provides a much greater perspective and view of the associated anatomic structures when compared to open abdominal approaches or thorascopic approaches. Avoidance of injury to the vagus nerves is relatively easy since the vagus nerves are easily identified in the mediastinum with the high resolution magnification of the laparoscope. Relatively high risk patients may undergo this operative procedure even when their disease process has persisted for many years—or when a recurrent incarcerated hernia is present for many years. Technical aspects associated with reduction of the hernia have been delineated and include reduction of the sac along with the hernia. Morbidity and mortality is low and the patients are subjectively dramatically improved, and their lifestyle is significantly improved.

### **Laparoscopic Diaphragmatic Hernia Repair: A Feasibility Study for Neonatal Minilaparoscopy**

Blair Jobe, MD, Luke Kinzie, RN, Lee Swanstrom, MD

#### **ABSTRACT**

**Objectives:** The purpose of this study was to evaluate the technical feasibility and physiologic impact of minilaparoscopic diaphragmatic hernia repair using the size/weight characteristics of the rabbit as an analogous neonatal model.

**Methods:** A Bochdalek hernia was simulated in five New Zealand white rabbits by excising the posterior half of the left hemi-diaphragm and eviscerating a portion of the small bowel and left colon into the chest. The celiotomy was closed and a primary laparoscopic diaphragmatic repair was carried out using 2 mm fiberoptic laparoscopes and instrumentation. Hemodynamic parameters and arterial blood gas measurements were obtained prior to and during CO<sub>2</sub> insufflation, and 20 minutes after desufflation.

**Results:** Minilaparoscopic reduction of hernia contents and repair of the diaphragmatic defect was completed in all animals without difficulty. All animals developed acidosis during CO<sub>2</sub> insufflation as evidenced by a decline in arterial pH and bicarbonate and rise in pCO<sub>2</sub>. Repair of the defect did not improve acid-base balance, and 20 minutes after desufflation arterial pH had improved but failed to return to baseline. There was no difficulty with oxygenation; however, there was a significant increase in peak inspiratory pressure after insufflation. Again, repair of the defect had no effect, but desufflation returned values to baseline.

**Conclusions:** Minilaparoscopic repair of the congenital diaphragmatic hernia is technically feasible. However, CO<sub>2</sub> pneumoperitoneum and pneumothorax result in a combined metabolic and respiratory acidosis with delayed resolution after

desufflation. Therefore, we believe it to be contraindicated for use in neonatal laparoscopy. Further studies are required utilizing alternate gases for insufflation or gasless technique in our congenital diaphragmatic hernia animal model.

### **New Procedure of Bowel Anastomosis Stenosis Revision with Stapler**

J.E. Morrison, Jr., MD, V.R. Jacobs, MD

#### **ABSTRACT**

**Objective:** Anastomosis stenosis is a complication after bowel surgery, especially after use of a 25 mm circular anastomosis stapler. We describe a new laparoscopy assisted endoscopic revision of bowel anastomosis stenosis with a linear stapler in three cases: #1) anastomosis stenosis 14 months after sigmoid colon resection, #2 and #3) inadequate-sized primary anastomosis after segmental colon resection requiring immediate revision.

**Methods and Procedures:** In a laparoscopy assisted procedure, a stapler, endoscopic linear cutter (Endopath ETS®, Ethicon, Cincinnati, OH), is transanally inserted and fired into the stricture of primary staple line to enlarge the anastomosis and the inner lumen of the colon. Hemostasis and integrity of the anastomosis is carefully observed.

**Results:** All patients had uncomplicated postoperative course and were discharged within 48-72 hours. At follow-up colonoscopy, between 9 and 11 months postoperatively all showed a widely patent anastomosis without stricture.

**Conclusions:** The procedure seems to be fast and safe, less invasive and cost effective. This new technique can be used to avoid surgery in cases of postoperative anastomosis stenosis as well as initially to increase the anastomosis diameter of the lower colon.

### **Laparoscopic Management of a Gastric Diverticulum: A Case Report**

Michael Fenoglio, MD, William Rainer, Jr., MD

#### **ABSTRACT**

**Objectives:** The purpose of this study is to present a case report of the presentation and management of a gastric diverticulum.

**Methods and Procedures:** We present a case of a 56 year old Spanish-American gentleman who presented with chronic epigastric pain and hemoccult positive stools. Initial workup, including an upper GI series, showed a large gastric diverticulum arising from the posterior surface of the gastric fundus measuring 7.0 cm in its maximum diameter. The patient underwent an upper GI endoscopy which confirmed the presence of this large gastric diverticulum. There was food stuff present in the diver-



ticulum, and biopsy of the mucosa revealed changes consistent with chronic gastritis.

**Results:** Patient underwent a laparoscopic exploration and excision of this gastric diverticulum. At the time of surgery this diverticulum was found to be arising from the posterior surface of the fundus near its greater curvature and was fairly adherent into the splenic hilum. This was carefully dissected away and excised at its base. Pathology of the specimen confirmed the gastric diverticulum with changes of chronic gastritis. The patient recovered uneventfully and had complete resolution of his preoperative symptoms.

**Conclusions:** We present a case of gastric diverticulum which is an unusual cause for epigastric pain. Management of this entity should include surgical excision which can be accomplished successfully through laparoscopic means. Accurate localization of the diverticulum preoperatively is essential in order to plan one's surgical approach. Intraoperative endoscopy may be helpful in locating this diverticulum and ensuring complete excision of its opening.

## Complications of Laparoscopic Colon Surgery

Muhammad Jawad, MD

### ABSTRACT

**Objectives:** Over a seven-year period, from September 1991 to June 1998, 121 colon resections were attempted laparoscopically. Seventy-two cases were completed, and 49 cases were converted to the open technique. Out of the 121 cases done, 47 were attempted for malignant colon lesions, while 74 cases were attempted for benign disease.

The decision to convert to the open technique is based on tumor grade T3 or T4, difficulty of the lesion to resect (inflammatory mass), severe adhesions, and intraoperative complications. Thirteen major complications occurred which required conversion to the open technique or which required a second operation.

Anastomotic Leak	1
Perforation of Rectal Stump with Dilator	3
Rectal Stump End Leak	2
Small Bowel Perforation	2
Anastomotic Stenosis	1
Recto-Vaginal Fistula	1
Abdominal Wall Recurrence	3

The anastomotic leak developed three weeks after surgery and resulted in the patient's death. Most of these complications were recognized intraoperatively and resulted in conversion to the open technique. These complications are not unique to the

laparoscopic-assisted colon resection except for the abdominal wall recurrence.

## An Analysis of Laparoscopic Revision of Ventriculo-Peritoneal Shunts

Sridhar Chalasani, MD, Nikhilesh Agarwal, MD

### ABSTRACT

Ventriculo-peritoneal shunts are often placed to relieve hydrocephalus. About 40-50% of the shunts may develop complications such as obstruction or infection. Obstruction of a shunt may be due to particulate/cellular matter, malpositioning within the abdomen or even entrapment within an abdominal cyst. Patients with an obstructed shunt present with symptoms of increased intracranial pressure.

We present a retrospective analysis of four cases which presented with malfunctioning shunts. All the shunts were revised via the laparoscopic approach, and patients were discharged without any problems. Preoperative diagnostic imaging showed obstruction of the distal end of the shunt.

All patients underwent exploratory laparoscopy, and the cause of obstruction was found within five minutes. The problem was rectified by relocating the shunt within the peritoneal cavity. Two of the cases required extensive dissection to free the shunt. Evidence that the shunt was now functional could be seen by the dripping of cerebrospinal fluid. The average operating time was 52.5 minutes (range 38-65). Postoperatively, all patients did well and were discharged to home without problems. The median length of postoperative stay was 1.5 days (range 1-14). All patients had complete resolution of symptoms after surgery.

We conclude that laparoscopic revision of ventriculo-peritoneal shunts is a feasible, practical and efficient way of managing obstructed distal shunts. The operating time, patient discomfort and hospital stay are reduced to a minimum. Preliminary analysis of the results show that laparoscopic revision of shunts appears to be superior to the open method.

## Pitfalls in Laparoscopy for Penetrating Trauma

Amber A. Guth, MD, Leon H. Pachter, MD

### ABSTRACT

**Background:** How should the stable patient with penetrating abdominal or lower chest trauma be evaluated? Evolving trends have recently included the use of diagnostic laparoscopy. In September 1995 we instituted a protocol of diagnostic laparoscopy to identify those patients who could safely avoid surgical intervention.

**Design:** Prospective case series.

**Materials and Methods:** Hemodynamically stable patients with penetrating injuries to the anterior abdomen and lower chest were prospectively evaluated by diagnostic laparoscopy, performed in the operating room under general anesthesia, and considered negative if no peritoneal violation or an isolated non-bleeding injury had occurred. If peritoneal violation, major organ injury or hematoma was noted, conversion to open celiotomy was undertaken.

**Results:** Seventy consecutive patients were evaluated over a two-year period. The average length of stay (LOS) following negative laparoscopy was 1.5 days, and for negative celiotomy 5.2 days. There were no missed intra-abdominal injuries following negative laparoscopy. The technique also proved useful in evaluation of selected blunt and HIV+ trauma victims with unclear clinical presentations. However, while laparoscopy was accurate in assessing the abdomen following penetrating lower chest injuries, significant thoracic injuries were missed in 2/11 patients who required subsequent return to OR for thoracotomy.

Site of injury	# patients	Positive Laparoscopy	Therapeutic Laparotomy	Negative Laparoscopy	Missed injury: Return to OR
lower chest	11	1/1	1/1	10	2
abdomen	59	39	25/39	20	0

**Conclusions:** Laparoscopy has become a useful and accurate diagnostic tool in the evaluation of abdominal trauma. Nevertheless, laparoscopy still carries a 20% nontherapeutic laparotomy rate. Additionally, significant intrathoracic injuries may be missed when laparoscopy is used as the primary technique to evaluate penetrating lower thoracic trauma.

**Pulmonary Parenchymal Abscess VATS Approach to Diagnosis and Treatment**

Heron E. Rodriguez, MD, Irvin M. Wiesman, MD,  
Mark M. Connolly, MD, Francis J. Podbielski, MD

**ABSTRACT**

Etiologies of focal lung abscess include aspiration, post-pneumonic, embolic, and those secondary to bronchial obstruction. Medical therapy is the first line of treatment and usually entails chest physiotherapy, inhalational agents, and intravenous antibiotics. Failure of treatment often necessitates multiple therapeutic bronchoscopies along with radiographically guided or open drainage procedures. Anatomic pulmonary resection is generally not an option due to diffusely inflamed lung parenchyma.

This patient presented to his primary care physician with productive cough and fever. A chest radiograph demonstrated an infiltrate in the left lower lobe. He completed a two-week course of oral antibiotics without resolution of symptoms. The patient

was then admitted to the hospital where computed tomography of the chest showed a focal fluid collection in the left lower chest. Flexible bronchoscopy yielded no obstructing endobronchial lesions and a negative lavage culture. After two weeks of intravenous antibiotic therapy and three attempts at computed tomographic drainage, he remained febrile with an elevated peripheral blood leukocyte count. A left VATS was performed and showed no effusion fluid, but an area of parenchymal carnification. This area was endoscopically unroofed and debrided. Thoracostomy drainage tubes placed at the time of operation were removed after one week.

The patient was discharged from the hospital on home intravenous antibiotics. At eight months follow-up, the initially noted residual cavity had become completely obliterated.

We conclude that parenchymal lung abscesses are amenable to video-endoscopic techniques of debridement and drainage. Furthermore, prompt, more aggressive treatment in this case might have resulted in a shorter hospitalization and an earlier return to health.

**Re-operation of Essential Hyperhidrosis**

Yong Han Yoon, MD, Doo Yun Lee, MD, Hae Kyo Kim, MD,  
Hyun Min Cho, MD

**ABSTRACT**

**Background:** Thoracic sympathectomy for palmar hyperhidrosis has a recurrence rate of 0-5%, either in the immediate post-operative period or later in the follow-up. Thoracic sympathectomy is the treatment of choice.

**Patients and Methods:** From January 1992 to October 1997, thoracic sympathectomy was performed for recurrent hyperhidrosis by video-assisted thoracic surgery (VATS) in five patients, two males and three females, with a mean age of 20.

**Results:** All patients had moderate to severe pleural adhesions in the previous sympathectomy sites, but no operative complications or crossover to thoracotomy occurred. Surgery resulted in satisfactory outcomes.

**Conclusion:** The results of the data showed that VATS sympathectomy was effective in treating recurring hyperhidrosis. Prevention of recurrence and postoperative complications require the identification and resection of the second thoracic sympathetic ganglion in its normal and variant appearance as well as the Kuntz fibers.

## Cost Comparison of Thoracoscopic Assisted Talc and Bedside Chemical Pleurodesis in the Treatment of Malignant Pleural Effusions

Michael Bono, MD, Ira Miller, MD

### ABSTRACT

**Objective:** Thoracoscopic assisted talc pleurodesis, a technique popular in Europe, has made recent re-emergence in the treatment of malignant pleural effusions. Numerous studies show this to be more successful in resolution without reaccumulation of malignant pleural effusions compared to bedside chemical pleurodesis. No study to date evaluates the cost-effectiveness of these procedures.

**Methods:** A retrospective analysis of patients treated for malignant pleural effusions comparing the hospital duration and costs incurred for both single and accumulated readmission treatment strategies. Statistical analysis was performed by nonparametric technique.

**Results:** Thirty-five patients diagnosed with malignant pleural effusions at Sentara Bayside Hospital had 41 admissions from January 1994 to December 1997. Patients admitted and treated solely by either bedside chemical pleurodesis or thoracoscopic assisted talc pleurodesis totaled 9 and 4, respectively, with readmission for treatment failure being 2 for bedside chemical pleurodesis and none for thoracoscopic assisted talc pleurodesis. Comparison of average duration of stay found 17 and 10 days ( $p=0.06$ ) with an average cost of \$21,600 and \$16,800 ( $p=NS$ ), respectively. Comparison of accumulated readmission data per patient found an average duration of stay of 19 and 10 days ( $p=0.03$ ) with an average cost of \$24,300 to \$16,800 ( $p=NS$ ), respectively.

**Conclusions:** There was a significantly shorter hospital stay for patients treated by thoracoscopic assisted talc pleurodesis. There was no significant difference of cost incurred between bedside chemical pleurodesis and thoracoscopic assisted talc pleurodesis. Therefore, thoracoscopic assisted talc pleurodesis should be considered for the primary treatment of malignant pleural effusions to allow better quality of remaining life.

## Video-Assisted Thoracoscopic Assessment of Pulmonary Blastomycosis

Irvin M. Wiesman, MD, Francis J. Podbielski, MD,  
M. Janeen Hernan, MSN, Marin Sekosan, MD,  
Wickii T. Vigneswaran, MD

### ABSTRACT

Blastomycosis is endemic in river valley areas of the southeastern

and midwestern United States. While there is no overall age, race, sex, or occupational predilection for the disease, people exposed to soil in endemic areas are at greatest risk. Common clinical manifestations include fever and chronic cough. Definitive diagnosis relies on growth of the organism from body fluids or biopsy specimens.

This patient presented to an outside institution with a chief complaint of productive cough, fever to 39°C, and shaking chills. After a presumptive diagnosis of pneumonia and sputum cultures demonstrating normal respiratory flora, she was begun on a two-week course of oral antibiotics. Multiple thoracenteses were performed, with reaccumulation of her large pleural effusion and development of hilar adenopathy. Failure of her treatment regimen led to video-assisted thoracoscopic (VATS) pleural and lung biopsy. Histologic examination revealed multinucleated yeast forms of *Blastomyces dermatitidis*.

Treatment of localized pulmonary disease with oral azole derivatives has been successful. This patient's extensive hilar adenopathy and suspicion of systemic disease prompted treatment with a six-week course of intravenous amphotericin B.

Given the low propensity of *Blastomyces dermatitidis* for pleural involvement, it is not surprising that thoracentesis is generally non-diagnostic. Operative findings of diffuse pleural blastomycotic studding in this case might explain development of recurrent loculated effusions. It is not clear, however, why the organism was not cultured from the two pre-operative thoracentesis samples obtained, given the widespread pleural involvement. The utility of video-assisted thoracoscopic surgery in the evaluation of patients with uncommon etiologies of pleural effusion cannot be underestimated.

## Thoracoscopic Plication of the Diaphragm without the Use of Mini-Thoracotomy

Richard Freeman, MD, James Schneider, MD

### ABSTRACT

During an evaluation for incapacitating dyspnea on exertion (DOE) and recurrent right middle and lower lobe pneumonia, a 49 year old, non-smoking male was found to have an idiopathic paralysis of the right phrenic nerve. He was referred for plication of the right hemidiaphragm when his shortness of breath forced him to leave his job as an automobile mechanic. This was accomplished thoracoscopically using a recently developed endoscopic suture device (Endo Stitch; Auto Suture Corporation). Immediately after surgery, the patient noticed a significant improvement in his DOE. Following his discharge on postoperative day 2, his symptoms continued to diminish, eventually allowing him to climb stairs and walk for long distances without shortness of breath. The patient returned to full-time employment on postoperative day 14. Pulmonary function testing per-

formed at three months demonstrated significant improvement.

	Preoperative	Postoperative	% change
FEVI	2.51 / 57%	3.74 / 85%	+28
MVV	67 / 40%	123 / 74%	+34
VC	3.75 / 59%	6.13 / 97%	+38
TLC	5.15 / 62%	7.69 / 93%	+31

Diaphragmatic plication was successful in this patient, alleviating his symptoms and allowing him to quickly return to work. The ability to perform this patient's procedure thoracoscopically minimized his hospital length of stay and recovery time while not compromising the technical integrity of the repair. The recently developed endoscopic suture device used in this case facilitated a decrease in procedure length while avoiding the need for a mini-thoracotomy.

## Laparoscopic Exposure of the L4-5 Level for Spinal Fusion

Ronald J. Aronoff, MD, John J. Regan, MD

### ABSTRACT

**Introduction:** The authors report their experience with 40 consecutive patients with exposure of the L4-5 level. Several questions have been raised about the feasibility of the approach to L4-5. These include lack of adequate exposure and unacceptably high incidences of retrograde ejaculation.

**Methods:** Forty consecutive patients with a mean age of 41 (29-53) underwent laparoscopic exposure of the L4-5 interspace from June 1994 to April 1998. The same team, using standard carbon dioxide insufflation laparoscopic techniques, performed all procedures. Operative reports and patient records were reviewed for the data collected.

**Results:** All 40 patients had at least partial exposure of the spine. Three variations of approach were identified. In 20 patients, the iliac vessels were mobilized from a midline approach. Thirteen patients had a high venous bifurcation allowing exposure without vessel mobilization. Seven patients had mobilization of the sigmoid colon to allow a complete retroperitoneal exposure of the interspace. The mean operative time was 180 minutes (range 100-300). Operative blood loss was 81 cc (range 20-200 cc). The length of stay was 3.1 days (range 1-6 days). Two patients had conversion to open laparotomy for venous bleeding. One patient had retrograde ejaculation after a multilevel exposure.

**Conclusions:** Laparoscopic exposure of the L4-5 interspace is reasonable and safe. Variations in vascular anatomy require different approaches that have impact on operative time and poten-

tial complications. Retrograde ejaculation has not been seen in any cases since the discontinuation of the use of monopolar cautery.

## Common Iliac Vein Injury During Laparoscopic Anterior Spine Fusion

G. Kevin Gillian, MD, Marcus Berry, MD,  
Constantinos Stratoulas, MD, Paul McAfee, MD,  
W. Peter Geis, MD

### ABSTRACT

**Objectives:** Since the advent of synthetic cages to accomplish spine fusion, anterior approaches rapidly gained momentum. The most common vertebral location requiring spine fusion is the L5-S1 interspace. This space is best and most safely accessed utilizing the transperitoneal laparoscopic approach. The laparoscopic surgeon's primary responsibility is to protect the vital soft tissue structures adjacent to the working area. The structure most closely adjacent to the L5-S1 disc is the left common iliac vein.

**Methods:** We performed 72 laparoscopic L5-S1 anterior spine fusions over the past 48 months. The only serious complications that occurred were injury to the left common iliac vein. In our series, these injuries occurred in two patients.

**Results:** In the two patients who experienced left common iliac vein injury, both were caused by spine fusion equipment which was used for reaming, tapping, and extracting disc material. In each case, the medial aspect of the common iliac vein was incised longitudinally. The mechanism was a combination of rotation motion which "sucked" the common iliac vein into the working space—in spite of retraction by the laparoscopic surgeon. In both circumstances, bleeding was controlled with pressure and intermittent suction. Attempts to perform laparoscopic repair of the common iliac vein were unsuccessful in both circumstances. In both cases, one and two units of blood were transfused and a lower midline incision was performed in order to repair the common iliac vein. In both circumstances, the spine fusion was completed. There were no postoperative complications.

**Conclusions:** Left common iliac vein injury is a potentially lethal technical complication associated with laparoscopic L5-S1 spine fusion. Responsibilities of the laparoscopic surgeon must include careful attention to retraction of surrounding vital structures including the common iliac vein. Proximal and distal dissection (and control) of the vein allow for very little blood loss if the vein is injured. Principles of vascular control apply and may be implemented in the laparoscopic environment. The use of intermittent suction decompresses the space and must be used sparingly. While potential carbon dioxide "air embolus" may occur secondary to a major vein injury, it is impossible to diminish the insufflation or eliminate the Trendelenburg position during the acute

circumstance—since these two variables provide adequate visualization of the working field.

## **Reverse Procedure to Correct a Previous T2-Sympathicotomy for Hyperhidrosis: Experience with 15 Cases**

Hsing-Hsien Wu, MD, Chien-Chih Lin, MD

### **ABSTRACT**

**Objectives:** Thoracoscopic T2-sympathicotomy is a popular method in the treatment of hyperhidrosis. But compensatory sweating is an inherited complication which needs further management on some post-T2-sympathicotomy patients. Though a procedure to reverse a previous surgical operation is rare and difficult, we developed a reversible T2 sympathetic block method by clipping in the treatment of hyperhidrosis for these patients post-sympathicotomically.

**Methods and Procedures:** We performed thoracoscopic T2-sympathetic block by clipping under general anesthesia. Two ports were used, one in the axilla and the other in the middle or posterior axillary line at the level of the nipple. Under video-assist, either end of the T2-sympathetic ganglion was clipped by endoscopic clips. The compression force of the clip is high enough to block the transmission of nervous impulse. If the patient was intolerable to compensatory sweating, reverse procedure was performed by inserting a thoracoscope with a functional channel through a single port at the axilla. The clips in situ were then removed by endoscopic forceps.

**Results:** There were 574 patients who underwent thoracoscopic approach for hyperhidrosis from March 18, 1996 to July 31, 1997. Of these, 550 cases (95.8%) underwent sympathetic block by clipping. Fifteen cases (2.7%, 4 males and 11 females) underwent reverse operation for intolerable compensatory sweating. Nine cases recovered from compensatory sweating and regained their sweaty hands to a satisfactory degree, while the remaining six are still being followed up.

**Conclusions:** Our conclusions are 1) reversible operation is possible after a surgical procedure; 2) sympathetic block through clipping is a reversible method in the treatment of hyperhidrosis; 3) summer is the ideal period for performing T2-sympathetic block by clipping for early and accurate assessment of the severity of compensatory sweating; and 4) adjusting the compression force of the clip achieves the desired degree of postoperative sweaty hands, thus avoiding compensatory sweating.

## **Thoracoscopic Sympathicotomy for Treatment of Rhinitis: Preliminary 64 Cases Report**

Seok-Mun Ng, MD, Chien-Chih Lin, MD

### **ABSTRACT**

**Objectives:** The purpose of this report is to find an alternative operation, besides vidian nerve section, in treatment of rhinitis, and also to discuss the therapeutic mechanism between sympathetic and parasympathetic unbalance.

**Methods and Procedures:** Cases of hyperhidrosis with rhinitis previously diagnosed by an oto-rhino-laryngologist were chosen in this study. There were 72 in 345 cases (20.9%) of hyperhidrosis with rhinitis who underwent T2-sympathicotomy between January 1 and December 31 of 1996. Sixty-four cases of hyperhidrosis (37 males and 27 females) completed the follow-up postoperatively, eight cases did not.

**Result:** Subjective cure of rhinitis after thoracic sympathicotomy was found in 20 cases (31.8%); 18 cases got subsidence of symptom of rhinitis, and in 26 cases (41.2%) there was no improvement. Persistently increased local temperature around frontal and nasal areas was found in thermography taken after thoracic sympathicotomy.

**Conclusions:** After an anesthesiologist's evaluation by stellate ganglion block preoperatively, thoracic sympathicotomy is an alternative method in the treatment of rhinitis, especially in cases of vasomotor rhinitis.

## **A Comparison of Laparoscopic and Open Appendectomy**

Michael Tarnoff, MD, Umar Atabek, MD,  
Martin Goodman, MD, James Alexander, MD,  
Francis Chranowski, MD, Keith Mortman, MD,  
Rudolph Camishon, MD, Mark Pello, MD

### **ABSTRACT**

**Objectives:** The purpose of this study was to compare laparoscopic appendectomy with traditional open appendectomy.

**Methods:** Seventy-one patients requiring operative intervention for suspected acute appendicitis were prospectively compared. Thirty-seven patients underwent laparoscopic appendectomy, and 34 patients had open appendectomy through a traditional right lower quadrant incision. Length of surgery, postoperative morbidity, and length of postoperative stay were recorded. Both groups were similar with regards to age, gender, height, weight, fever, leukocytosis, and incidence of normal versus gangrenous or perforated appendix.

**Results:** Mean length of stay was significantly shorter for patients

with acute suppurative appendicitis who underwent laparoscopic appendectomy (2.5 days vs. 4.0 days,  $p < 0.01$ ). Mean length of stay was no different when patients classified as having gangrenous or perforated appendicitis were included in the analysis (3.7 days vs. 4.1 days,  $P = 0.11$ ). The laparoscopy group had significantly lower surgery times (72 min vs. 58 min,  $p < 0.001$ ) compared to the open appendectomy group. There was no significant difference in the incidence of postoperative morbidity.

**Conclusions:** Laparoscopic appendectomy reduces the length of stay as compared to the traditional open technique in patients with acute suppurative appendicitis. The longer operative time for the laparoscopic approach in our study is likely related to the learning curve associated with the procedure and did not increase morbidity.

## Laparoscopic Appendectomy: A Three-Port Technique with No Open Conversions

Richard H. Koehler, MD

### ABSTRACT

**Objectives:** Approaches to laparoscopic appendectomy continue to evolve, with variable rates of open conversions and variable lengths of stay in comparison with open technique. The author's experience with a standardized three-port technique for laparoscopic appendectomy using high-frequency ultrasonic coagulation (Ethicon-EndoSurgery) is reviewed in 36 consecutive cases without need for conversion to an open format.

**Method:** Retrospective review, by a single surgeon/single community institution.

**Results:** Twenty-one females and 15 males, average age 35 years (14-67) underwent laparoscopic appendectomies (30 emergency/6 elective) utilizing a three-port technique. Thirty (84%) abnormal and 6 (16%) normal appendices were taken, with 7 (24%) being ruptured and 14 (38%) retrocecal. No cases required conversion to an open format. There were no bleeding complications, and one wound infection occurred in a ruptured appendix case (3%). Average operating time was 53 minutes (24-100). Average length of stay was 1.2 days (0.76 for non-ruptured cases and 3 days for ruptured cases). In 7 prior cases without ultrasonic coagulation, 2 (28%) were converted due to limitations with the use of cautery and stapling techniques on the mesoappendix.

**Conclusions:** This simple three-port technique allowed for successful removal of even difficult perforated retrocecal appendices. The use of ultrasonic coagulation allows dissection and division of the mesoappendix without the difficulties encountered with other modalities. Operating times were acceptable, with minimal morbidity and length of hospitalization when compared with open cases. Cosmetic appearance and patient satisfaction were excellent.

## Laparoscopic Adrenalectomy: A Community Hospital Experience

Ibrahim M. Ibrahim, MD

### ABSTRACT

Laparoscopic surgery of the adrenal gland has been explored primarily in the tertiary care setting; its role in the community hospital setting has, to date, not been determined. Stimulated by our laparoscopic results in the biliary tract, GI system, and even select hepato-pancreatic lesions, we undertook a program to assess the role of laparoscopy for tumors of the adrenal gland.

During the period of 1987-1997, 23 adrenalectomies were performed at the Englewood Hospital and Medical Center. Comparison of these procedures are summarized in the following table.

	No.	Benign	Malignant	Age (Mean)	OR Time (hrs.)	LOS (days)	Range LOS	Complications		
								Inf.	Bleeding	Death
Open	11	9	2	57	3	9	4-17	-	-	1
Lap	12	7	5	55	4.75	5	1-26	1	1	-

The single death in this series was due to extensive malignant lymphoma. There were no operative deaths. One minor infection at a trocar site responded to antibiotics. In another patient, bleeding in the bed of the excised adrenal gland was precipitated by the use of anticoagulants in turn felt to be necessary because of thrombophlebitis. Transfusions were not required for this patient and the bleeding ceased spontaneously. Our results indicate that laparoscopic adrenalectomy can be performed safely in the community hospital setting with minimal morbidity and mortality. Although these operations are lengthier, the subsequent LOS is definitely less ( $p < 0.05$ ). We believe that this data supports the concept of refining adrenal pathologic states and performance of laparoscopic adrenalectomy in the community environment.

## Laparoscopic Splenectomy in a Pregnant Patient

Cleveland W. Lewis, MD, Fred Brody, MD,  
Stephen W. Eubanks, MD

### ABSTRACT

A 34 year old female with a one-year history of symptomatic hemolytic anemia and two prior spontaneous abortions presented to our clinic 23 weeks pregnant. Intravenous corticosteroids and immunoglobulin therapy failed to obviate her need for multiple transfusions of packed red cells. Based on her refractory hemolytic anemia, a laparoscopic splenectomy was planned.

Following induction, fetal monitoring was employed and tocolyt-

ic agents were administered. The patient was placed in a modified right lateral decubitus position. Utilizing an open technique, the abdomen was entered through a supraumbilical midline incision placed cephalad to the palpable uterine fundus. Carbon dioxide insufflation pressure was gradually increased 15 mm Hg while ensuring hemodynamic stability in the mother and fetus. The angled laparoscope was inserted and the uterus was visualized at the level of the umbilicus. Four additional ports were inserted under laparoscopic visualization. The splenocolic ligament was divided with cautery scissors. The short gastric vessels were divided between hemoclips. The splenic artery and vein were divided with an endovascular stapler. After dividing the retroperitoneal attachments, the spleen was placed in a reinforced nylon bag and delivered to the abdominal wall. Finger fracture and sponge forceps were utilized to extract the spleen. Throughout the procedure, manipulation of the uterus was avoided. The patient was discharged on postoperative day 4. Further transfusions were not required. Subsequently, the patient delivered a healthy full-term infant.

Several series have documented the feasibility and safety of laparoscopic splenectomy. This case is the first laparoscopic splenectomy reported in a pregnant patient.

## Advanced Laparoscopic Techniques in the Pregnant Patient

Cleveland W. Lewis, MD, Fred Brody, MD,  
Stephen W. Eubanks, MD

### ABSTRACT

**Objectives:** A 34 year old female patient with a one-year history of hemolytic anemia presented to our clinic 23 weeks pregnant. Intravenous corticosteroids and immunoglobulin therapy failed to obviate her need for multiple transfusions of packed red cells. Based on her refractory symptoms, a laparoscopic splenectomy was planned.

Following induction, fetal monitoring was employed and tocolytic agents were administered. The patient was placed in a modified right lateral decubitus position. Utilizing an open technique, the abdomen was entered through a supraumbilical midline incision. Carbon dioxide insufflation pressure was increased to 15 mm Hg while ensuring hemodynamic stability in the mother and fetus. The angled laparoscope was inserted, and the uterus was visualized at the level of the umbilicus. Four additional ports were inserted under laparoscopic visualization. The splenocolic ligament was divided with cautery scissors. The short gastric vessels were divided between hemoclips. The splenic artery and vein were divided with an endovascular stapler. After dividing the retroperitoneal attachments, the spleen was placed in a reinforced nylon bag and delivered to the abdominal wall. Finger fracture and sponge forceps were utilized to extract the spleen.

The patient was discharged postoperative day 4. Further transfusions were not required. Subsequently, the patient delivered a healthy full-term infant.

Laparoscopy in the pregnancy patient requires emphasis on patient positioning, maternal and fetal monitoring, port placement and organ manipulation. This report of the first laparoscopic splenectomy in a pregnant patient demonstrates the feasibility and safety of advanced laparoscopic procedures in the gravid abdomen.

## Value of Laparoscopic Ultrasonography in Diagnostic Staging and Palliation of Peripancreatic Carcinoma

Curtis H.P. Peng, MD, Chen De, MD, Shao Zili, MD

### ABSTRACT

**Objectives:** To evaluate the value of laparoscopic ultrasonography (LapUS) in the diagnostic staging and palliation of peripancreatic carcinoma.

**Methods:** Laparoscopic ultrasonography was used from December 1996 to February 1998 in 26 consecutive patients with suspected peripancreatic malignancy and prospectively compared with other preoperative diagnostic imaging modalities. Emphasis was focused on detection of tumor extent, infiltration to surrounding vascular structure and metastases to peritoneum, liver and lymph nodes. Biopsies of suspected metastatic lesions and enlarged lymph nodes were taken under laparoscopic or LapUS-guidance using biopsy forceps or core-cutting biopsy needles for judgment of tumor resectability.

**Results:** LapUS found tumor adhesions in 24 out of 26 cases and another 2 cases of impacted stones in ampulla of Vater. The correct diagnosis was obtained by LapUS in 24 of 26 patients with diagnostic accuracy of 92.3%. There were no intraoperative or postoperative complications related to the laparoscopic procedure. The positive predictive value, negative predictive value, and accuracy of LapUS for assessment of tumor resectability were 94%, 86%, and 92%, respectively, with a sensitivity of 94% and specificity of 86%.

**Conclusions:** Laparoscopy with laparoscopic ultrasonography is an important component in the staging of pancreas and ampullary tumors and will improve diagnostic accuracy, optimize resectability, and avoid unnecessary laparotomy when routinely performed before exploration.

## **Laparoscopic Necrosectomy for Infected Necrotizing Pancreatitis**

Keith Gersin, MD, Todd B. Heniford, MD,  
Michel Gagner, MD, Jeffrey Ponsky, MD

### **ABSTRACT**

Infected necrotizing pancreatitis is a highly morbid disease. Management can require several operative interventions. Our group demonstrates a two-trocar retroperitoneal necrosectomy for infected necrotizing pancreatitis providing definitive treatment with a single operative procedure.

**Results:** There were no intraoperative or postoperative complications. The vasectomies were performed expeditiously. The total operative time was essentially not affected. All three patients had a postoperative semen evaluation at their two-month follow-up office visit. Each specimen confirmed the absence of sperm.

**Conclusion:** Although this is a more invasive approach to a common urologic procedure, a laparoscopic vasectomy is safe, effective, and can be performed in conjunction with a laparoscopic preperitoneal inguinal herniorrhaphy. ■

## **Laparoscopic Duodenojejunostomy for Treatment of SMA Syndrome**

Keith Gersin, MD, Todd B. Heniford, MD, Jeffrey Ponsky, MD

### **ABSTRACT**

Superior mesenteric artery syndrome occurs predominantly in thin patients. There are few reports in the literature concerning laparoscopic management of this disorder, including mobilization of the ligament of Treitz. Our group demonstrates the first laparoscopic duodenojejunostomy for treatment of this syndrome.

## **Laparoscopic Vasectomy: A Technique for Desired Sterility in Three Patients Having a Laparoscopic Preperitoneal Inguinal Hernia Repair**

Brent D. Matthews, MD, Gary B. Williams, MD

### **ABSTRACT**

**Objective:** To describe a laparoscopic technique for vasectomy in patients desiring sterility who undergo a laparoscopic preperitoneal inguinal herniorrhaphy.

**Methods and Procedures:** Three patients with reducible inguinal hernias presented for laparoscopic repair. Two patients had bilateral inguinal hernias, and one patient had a unilateral inguinal hernia. In addition, all three patients desired elective sterility. A standard three-port technique employed for laparoscopic transabdominal preperitoneal inguinal hernia repair was utilized. The vas deferens were easily identified and isolated medially and posteriorly on the preperitoneal pelvic floor in each patient. A 1.5 to 3.0 cm in length segment of vas deferens was removed on each side after the application of hemoclips proximally and distally. A preperitoneal mesh repair was then completed for the inguinal hernias. Follow-up was out to two months.